(54) Title: METHOD FOR HANDLING FLOW CONTROL IN PACKET SWITCHED MOBILE COMMUNICATION NETWORK

(57) Abstract: A method related to packet switched mobile communication networks for handling flow control in core network nodes in networks using the serving node pool concept is disclosed. According to a preferred embodiment of the present invention, a BSS sets up several NSEs (Network Service Entity), one for each SGSN (Serving GPRS Support Node) to which the BSS is connected. As before, one or more NS-VS is/are set up between each of the NSEs in the BSS and the corresponding NSE in the SGSN. However, the BSS uses the same BVCI (BSSGP Virtual Connection Identifier) towards each of the SGSN in the pool to represent the same physical Radio Cell. The NSEI parameter is preferably structured in such way that one part represents the BSS side, and another part represents the SGSN side.

ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)
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METHOD FOR HANDLING FLOW CONTROL IN PACKET SWITCHED MOBILE
COMMUNICATION NETWORK

Field of the invention

The present invention is related to packet switched mobile
communication networks, in particular to handling flow
control in core network nodes within such networks.

5   **Background of the invention**

In packet switched mobile communication networks, such as
GPRS and UMTS, applications (wap/internet browsing, e-mail,
LAN access etc) are provided to the users' terminals by
means of so-called sessions. In the terminology of GPRS and
10   UMTS, these sessions are referred to as PDP contexts. These
PDP Contexts are activated/deactivated and handled by the
SGSN currently serving the user's MS. An MS is allowed to
have several simultaneously activated sessions (PDP
contexts).

15   A simplified illustration of parts of a GPRS mobile
telephony system is shown in Figure 1. The SGSN controls
the PDP Context for the MS while the BTS and the BSC
control the required radio resources.

In order to decide the current limitations for how the
20   SGSNs and the Radio Access Network (RAN) nodes can control
the traffic in one geographical area, one can look at 3GPP
(3rd Generation Partnership Project, which is a
standardisation organisation); Technical Specification
23.002 and 08.18. Here, some text from the circuit switched
25   (CS) domain is also included since the description of this
domain is better than the corresponding text for the packet
switched (PS) domain. But, since the Mobile-services
Switching Centre (MSC) in the CS domain is the analogue to
the SGSN in the PS domain, this should also be applicable
30   in the PS domain.

The Mobile-services Switching Centre is an exchange that
performs all the switching and signalling functions for

mobile stations located in a geographical area designated as the MSC area.

The Base Station System (BSS) is the system of base station equipment (transceivers, controllers, etc.) which is viewed by the MSC through a single A-interface as being the entity responsible for communicating with Mobile Stations in a certain area. Similarly, in PLMNs (Public Land Mobile Network) supporting GPRS, the BSS is viewed by the SGSN through a single Gb interface (the interface between an SGSN and a BSS).

Where an Abis-interface (the interface between a BTS and a BSC) is implemented, the BSS consists of one Base Station Controller (BSC) and one or more Base Transceiver Station (BTS).

A Base Station Controller (BSC) is a network component in the PLMN with the functions for control of one or more BTS.

A Base Transceiver Station (BTS) is a network component that serves one cell.

A problem related to traffic flow in the Gb interface is that only one MSC, and therefore also one SGSN, is allowed to communicate with MSs in one geographical area, and therefore also within a specific radio cell. Within one radio cell, this communication is handled through one BSC and one BTS. (BSS is a logical concept, and it can contain several BSCs, where each of the BSCs is responsible for their own area.)

To control the amount of traffic an SGSN can send towards a BSC, a flow control mechanism is specified in the BSSGP (Base Station System GPRS Protocol) protocol. BSSGP is defined in 3GPP (3rd Generation Partnership Project, which is a standardisation organisation) Technical Specification (TS) 08.18 and 3GPP TS 48.018. In this downlink flow

control procedure, the BSC informs the SGSN of the allowed
amount of traffic that the SGSN can send towards the BSC
for each MS and for each radio cell, and the SGSN holds a
mirrored image of the situation in the BSC. Until now, only

5   one SGSN can be connected towards a BSC, as described
above. The simplified picture shown in figure 2 illustrates
how the flow control procedure is defined on the Gb
interface, the interface between the SGSN and BSC.

In this figure, PDP Contexts 1 and 2 belongs to MS 1, and

10 PDP Contexts 3 and 4 belongs to MS 2. For simplicity, only
one radio cell is included, but the BSC can control several
radio cells, where each of the radio cells is controlled by
a BTS.

In order to go into more details on the use of concepts

15 defined for the flow control procedure, the 3GPP TSs
defining the Gb interface must be looked at.

3GPP TS 48.016 and 3GPP TS 48.018 describe the Gb
interface. These TSs describe an option to either use the
Internet Protocol (IP) for transferring messages, or to use

20 the Frame Relay (FR) for transferring messages, but they
very much use the same concepts. Therefore, the below
description applies to both of them.

There is one or more Network Service Entity (NSE) at each
side of the Gb interface, i.e. at the BSS and at the SGSN.

25 This signifies that the NSE is a logical entity, and it
provides a communication service to the above protocol
layer, or Network Service (NS) user entity, enabling the
above protocol layer to communicate with its peer. The
peer-to-peer communication between remote NS user entities

30 is performed over BSSGP Virtual Connections (BVCs).

Each Network Service Entity is identified by means of a
Network Service Entity Identifier (NSEI).

The NSEI has an end-to-end significance across the Gb interface.

The NSEI is used by the BSS and the SGSN to determine the Network Service Virtual Connections (NS-VCs) that provide
5   service to a BSSGP Virtual Connection (BVC).

An NS-VC is a communication path between an SGSN and a BSC.

A BVC is a virtual communication path between Network Service user peer entities. A BVC represents a radio cell, and it is identified by a BVCI (BVC Identifier). Since a
10   BVCI used in the BSSGP protocol does not uniquely identify a physical radio cell, it is a logical representation of a radio cell.

The NSEI together with the BVCI uniquely identifies a BSSGP Virtual Connection (BVC) or a physical radio cell within an
15   SGSN. Therefore, each BVCI is unique between two Network Service Entity peers.

To make one concrete example, although somewhat simplified, one can say:

A BSC is represented by an NSEI, and the SGSN will have a
20   corresponding NSEI towards this BSC.

Between the NSEI in the BSC and the corresponding NSEI in the SGSN, one or more NS-VCs is/are connected. (In Gb over IP, an NS-VC is represented by one User Datagram Protocol (UDP) port and an IP address in the BSC, and one UDP port
25   and an IP address in the SGSN. In Gb over FR, an NS-VC represents one FR link.)

The different radio cells, or BVCIs, are then connected to the NSEI.

To summarize all the above text in a picture, Fig. 3 shows
in a simplified way, how the concepts of the Gb interface
are used. A comment to the figure is that the 3GPP TSs for
the Gb interface do not restrict several SGSNs from
5   accessing the same physical radio cell (since they are only
dealing with the interface between the SGSN and the BSC (or
the BSS)), but 3GPP TS 23.002 sets this restriction.

All the above is existing functionality. 3GPP (3rd
Generation Partnership Project), which is a standardisation
10 body, is now looking at a concept where a BSC can be
connected towards several SGSNs, as shown in Fig. 4. This
has several advantages, e.g. better load sharing between
the SGSNs, reduced signalling in the core network, better
in-service performance for the network, better scalability
15 in the network, and easier upgrade of the SGSNs.

The dotted lines in Fig. 4 show what is new with the pool
concept, i.e. that a BSC can be connected to two or more
SGSNs.

When connecting several SGSNs to the same BSC and letting
20 all these SGSNs access the same radio cell, a new aspect is
added to the flow control procedure. The BSC must now
control the downlink traffic from each of the SGSNs to
secure that the total possible downlink traffic towards a
radio cell is not violated. To avoid different
25 interpretations by different vendors, and hence different
implementation of the telecommunication equipment supplied
by these vendors, it must be agreed upon how to perform
this flow control procedure in an SGSN pool. Also, it
should be agreed upon how to use the concepts that are used
30 in the 3GPP TSs describing the Gb interface in an SGSN
pool.

As the above-described problems are not solved by 3GPP,
they are left to each vendor, and consequesly, several more
or less effective interpretations may appear.

Summary of the invention

It is an object of the present invention to provide a
method that solves the problem described above. The
features defined in the independent claims enclosed
5   characterize this method.

Brief description of the drawings

In order to make the invention more readily understandable,
the discussion that follows will refer to the accompanying
drawings.

10 Fig. 1 shows a simplified illustration of parts of a GPRS
mobile telephony system,

Fig. 2 shows a simplified picture of Flow Control on the Gb
interface indicated in Fig. 1 in downlink direction,

Fig. 3 is a view of the virtual communication paths on the
15 Gb interface according to 3GPP release 4,

Fig. 4 shows a simplified illustration of parts of a GPRS
mobile telephony system when applied to a pool concept,

Fig. 5 is a view of the virtual communication paths on the
Gb interface according to the present invention,

20 Fig. 6 is a view of the virtual communication paths on the
Gb interface according to another aspect of the present
invention.

Description of the present invention

The present invention provides a solution for the problem
25 mentioned above by using (in the BSC or BSS) the existing
flow control procedure on cell level (defined in 3GPP
release 1999) to control each of the SGSNs in a way not to

violate the total possible traffic on a cell. Also, the
existing messages within this flow control procedure should
be used.

The BSC can decide to share the downlink traffic on a cell
between each of the SGSNs in several ways, and below some
alternatives are listed.

- The possible downlink traffic can be equally shared
  between the SGSNs of the pool.

- The portion of each SGSN can be proportional to (or in
  some way be related to) the processing capacity of the
  SGSN.

- The portion of each SGSN can be proportional to the
  current traffic demands from each of the SGSNs.

When going into more details, Fig. 5 shows the preferred
way of how the existing concepts on the Gb interface and in
the BSSGP protocol could be used in an SGSN pool.

According to a preferred embodiment of the present
invention it is suggested that:

The BSC (or BSS or Packet Control Unit (PCU)) sets up
several NSEs, each identified by a separate NSEI, and where
the NSEs go towards one SGSN each, and all of the NSEs then
together are connected towards all the SGSNs in the pool.
As an alternative, several NSEs in the BSC (or BSS or PCU)
are connected towards each of the SGSNs. One or more NS-VC
is/are then set up between each of the NSEs in the BSC (or
BSS or PCU) and the corresponding NSE in the SGSN, as
before. The identity of the NS-VC is unique within an NSEI.

The BSC (or BSS or PCU) uses the same BVCI value towards
each of the SGSNs in the pool to represent the same
physical radio cell.

Each of the NSEIs (alternatively, all the NSEIs going from one BSC (or BSS) towards one SGSN) can either be connected to one Packet Control Unit (PCU) each, or all the NSEIs covering the same geographical area can be connected to the same PCU.

The NSEI parameter (alternatively a new parameter substituting the NSEI, or a new parameter used together with the NSEI) could be structured in such a way that one part represents the BSC side (or the like, e.g. BSS or PCU), and another part represents the SGSN side. In this way, the NSEI parameter will give uniqueness on the Gb interface over several BSCs (or BSS or PCU). By doing so, each of the NSEIs in Fig. 5 can even be located in different BSCs (or BSSs or PCUs).

Fig. 6 shows a second embodiment of the present invention. This is a way of how the existing concepts on the Gb interface and in the BSSGP protocol could be used in an SGSN pool.

According to this embodiment, the BSC (or BSS or PCU) sets up one common NSE, and this is going towards each of the SGSNs in the pool. In other words, for a specific cell, all the SGSNs see the same NSEI. One or more NS-VC(s) is/are then set up between the NSE in the BSC (or BSS or PCU), and the corresponding NSEs in the SGSN, as before. (As an alternative, the BSC (or BSS or PCU) sets up several NSEs, and all of them are going towards each of the SGSNs in the pool).

The BSC (or BSS or PCU) uses the same BVCI value towards each of the SGSNs in the pool to represent the same physical radio cell.

One disadvantage with this proposal compared to the preferred alternative described above, is that the NSEI

parameter is no longer unique over the Gb interface in the uplink direction (from the BSC (or BSS or PCU) to SGSN).

The present invention specifies how the flow control procedure should be done, as well as how to use the
5   concepts on the Gb interface, when introducing SGSN pools. Therefore, this will avoid different interpretations by different vendors, and hence different implementation of the telecommunication equipment supplied by these vendors.

The preferred alternative of the present invention
10 (described in Fig. 5) also has the advantage of keeping an end to end significance for the NSEI parameter over the Gb interface when introducing the pool concept in a GPRS network. This further has the advantage of simplifying the configuration and implementation of the Gb interface
15 functionality.

Abbreviations

RAN   Radio Access Network

3GPP   3rd Generation Partnership Project

CS   Circuit Switched

5   PS   Packet Switched

MSC   Mobile-services Switching Centre

BSS   Base Station System

SGSN   Serving GPRS Support Node

PLMNs   Public Land Mobile Network

10 Gb interface   the interface between an SGSN and a BSS

Abis-interface   the interface between a BTS and a BSC

BSC   Base Station Controller

BTS   Base Transceiver Station

QoS   Quality of Service

15 MS   Mobile Station

IP   Internet Protocol

FR   Frame Relay

NS   Network Service

BVCs   BSSGP Virtual Connections

NSEI   Network Service Entity Identifier

NS-VCs   Network Service Virtual Connections

BVC   a BSSGP Virtual Connection

NS-VC   communication path between an SGSN and a BSC

5   BVC   a virtual communication path between Network
            Service user peer entities

BVCI   BVC Identifier

BVC   BSSGP Virtual Connection

UDP   User Datagram Protocol

10 NSE   Network Service Entity

NSEI   Network Service Entity Identification

PCU   Packet Control Unit

References

[1]   3GPP overall architecture. 3GPP TS 48.016

[2]   3GPP overall architecture. 3GPP TS 48.018

[3]   3GPP overall architecture. 3GPP TS 23.002

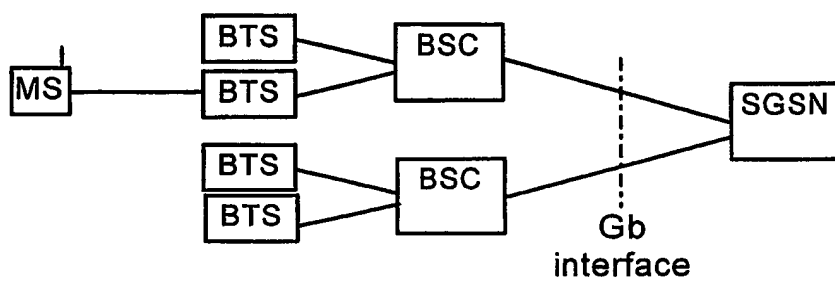[4]   3GPP overall architecture. 3GPP TS 08.18

Patent claims

1.   Method in a packet switched mobile communication network comprising Base Transceiver Stations (BTSs) each associated with one or more radio cells each identified by a cell identifier, a Base Station System, Base Station Controller or Packet Control Unit (BSS/BSC/PCU) or a similar node or unit controlling one or more BTSs, and serving nodes each being able to serve the BSS/BSC/PCU, wherein each connection between the serving nodes and the BSC is provided by a virtual connection between two virtual entity peers, one associated with the BSS and one with the respective serving node,
c h a r a c t e r i z e d   i n

  a) establishing one or more virtual entities for each serving node in the BSS/BSC/PCU, each identified by a virtual entity identifier unique for the respective serving nodes,

  b) establishing one or more virtual connection for each virtual entity established in a),

  c) representing a certain radio cell towards all the serving nodes using the same cell identifier.

2.   Method according to claim 1,
c h a r a c t e r i z e d   i n   that communication between the BSS and the serving nodes is implemented by a Gb interface and according to a BSSGP protocol wherein the cell identifiers are BCVIs, the virtual entities are NSEs, the virtual entity identifiers are NSEIs, and the virtual connections are NS-VCs.

3.   Method according to claim 1 or 2,
c h a r a c t e r i z e d   i n   that said serving nodes are SGSNs in a GPRS network.

4.   Method according to one of the claims 1-3,
c h a r a c t e r i z e d   i n   the following additional
step:

- distributing downlink traffic to the BSS equally
  between the serving nodes.

5.   Method according to one of the claims 1-4,
c h a r a c t e r i z e d   i n   the following additional
step:

- distributing downlink traffic to the BSS/BSC/PCU so
  that a portion of the downlink traffic going through a
  certain serving node is proportional to a processing
  capacity of that serving node.

6.   Method according to one of the claims 1-5,
c h a r a c t e r i z e d   i n   the following additional
step:

- distributing downlink traffic to the BSS/BSC/PCU so
  that a portion of the downlink traffic going through a
  certain serving node is proportional to current
  traffic demands from that serving node.

7.   Method in a packet switched mobile communication
network comprising Base Transceiver Stations (BTSs) each
associated with one or more radio cells each identified by
a cell identifier, a Base Station System, Base Station
Controller or Packet Control Unit (BSS/BSC/PCU) or a
similar node or unit controlling one or more BTSs, and
serving nodes each being able to serve the BSS/BSC/PCU,
wherein each connection between the serving nodes and the
BSS/BSC/PCU is provided by a virtual connection between two
virtual entity peers, one associated with the BSS/BSC/PCU
and one with the respective serving node,
c h a r a c t e r i z e d   i n

a) establishing one single virtual entity in the BSS,

b) establishing one or more virtual connection for each
   serving node wherein the single virtual entity
   established in a) is the common virtual entity peer
   associated with the BSS/BSC/PCU for all the virtual
   connections,

c) representing a certain radio cell towards all the
   serving nodes using the same cell identifier.

8. Method according to claim 7,
c h a r a c t e r i z e d   i n   that communication between
the BSS and the serving nodes is implemented by a Gb
interface and according to a BSSGP protocol wherein the
cell identifiers are BCVIs, the virtual entities are NSEs,
the virtual entity identifiers are NSEIs, and the virtual
connections are NS-VCs.

9. Method according to one of the claims 7 or 8,
c h a r a c t e r i z e d   i n   that said serving nodes
are SGSNs in a GPRS network.

10. Method according to one of the claims 7-9,
c h a r a c t e r i z e d   i n   the following additional
step:

   • distributing downlink traffic to the BSS/BSC/PCU
     equally between the serving nodes.

11. Method according to one of the claims 7-10,
c h a r a c t e r i z e d   i n   the following additional
step:

   • distributing downlink traffic to the BSS/BSC/PCU so
     that a portion of the downlink traffic going through a
     certain serving node is proportional to a processing
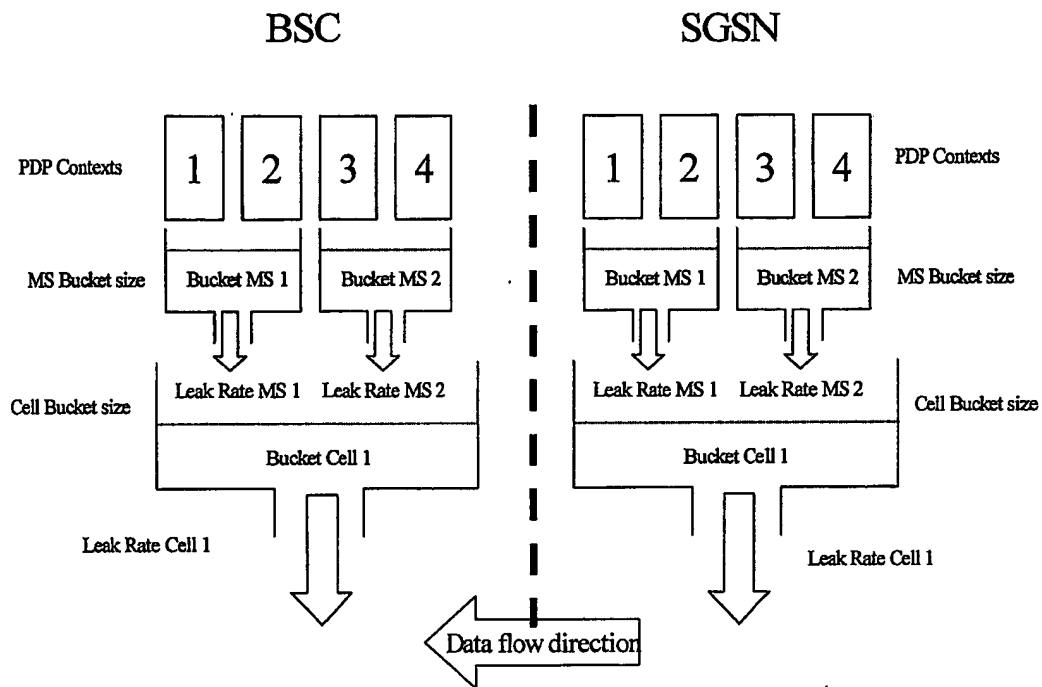   capacity of that serving node.

12. Method according to one of the claims 7-9,
c h a r a c t e r i z e d   i n   the following additional
step:

- distributing downlink traffic to the BSS/BSC/PCU so
  that a portion of the downlink traffic going through a
  certain serving node is proportional to current
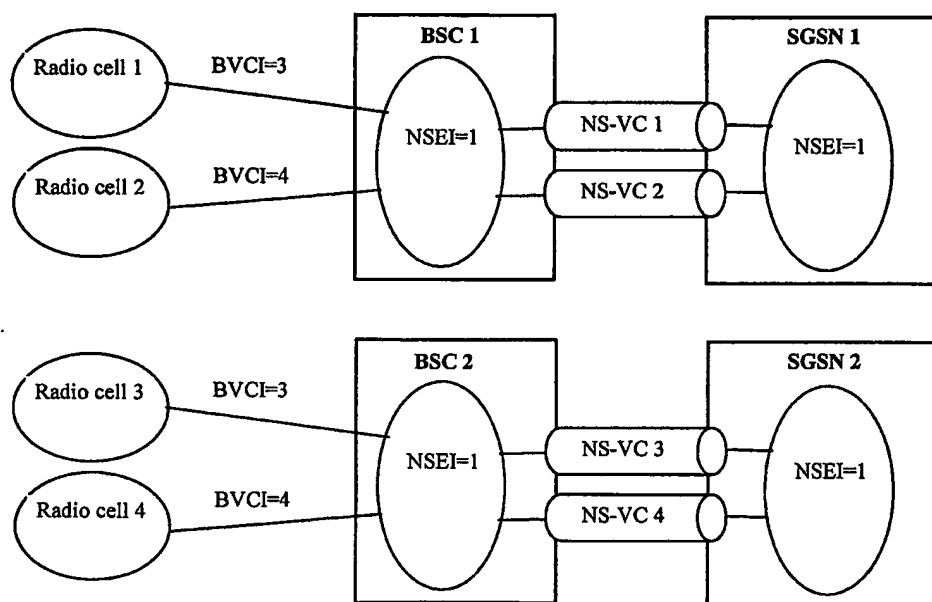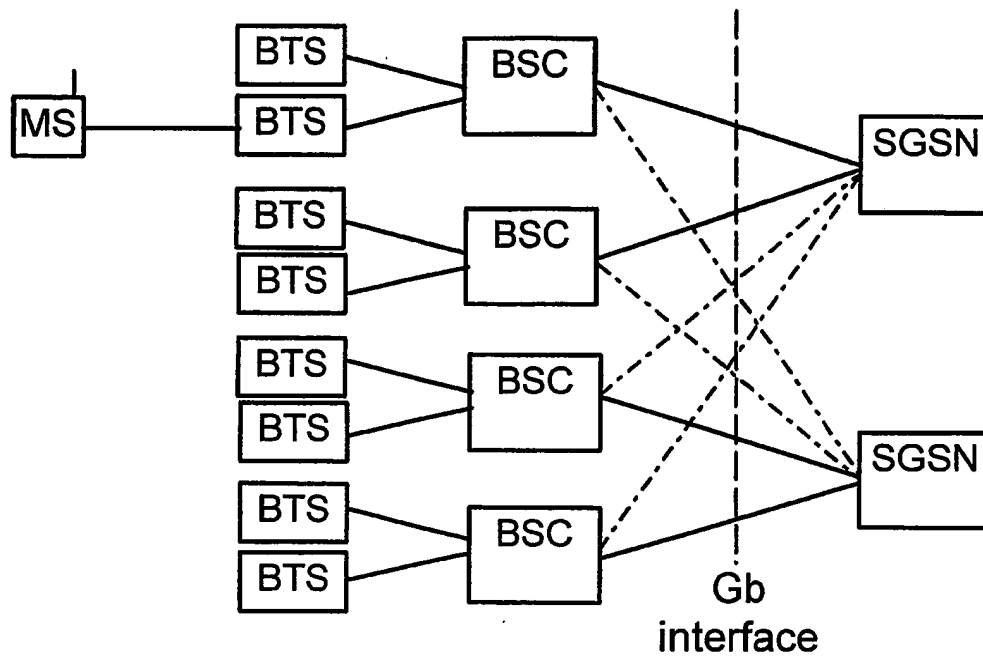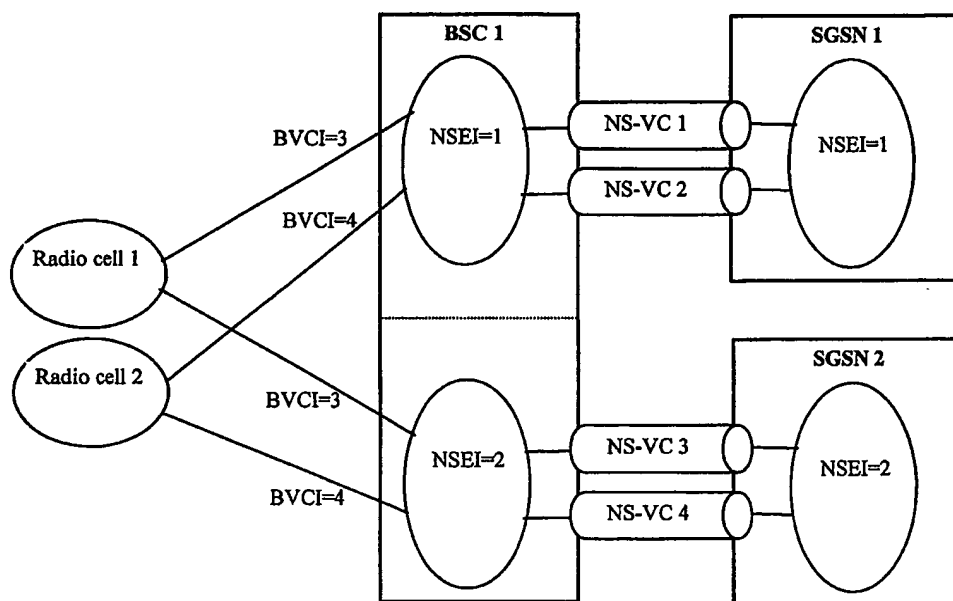 traffic demands from that serving node.

Fig. 1

Fig. 2

Fig. 3

Fig. 4
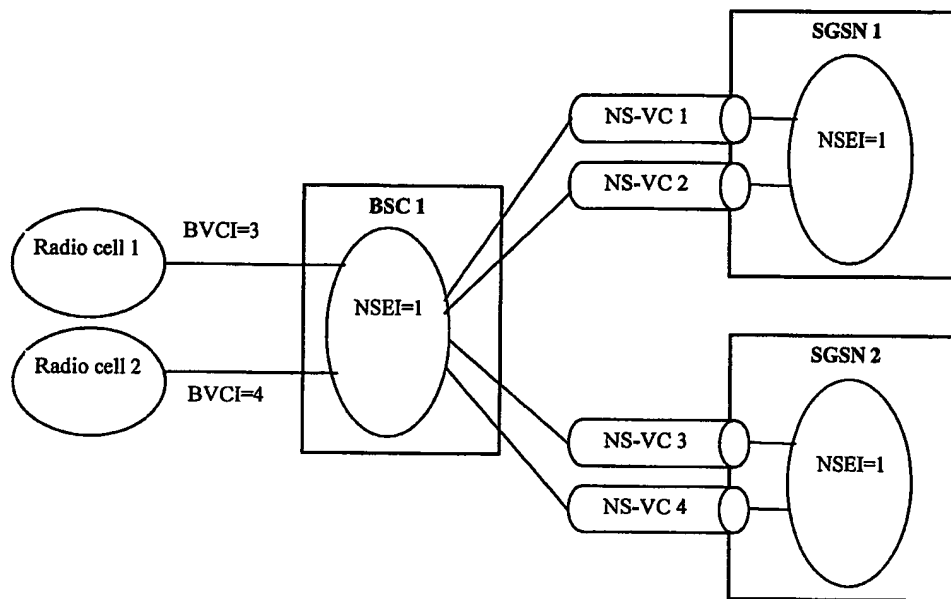
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Fig. 5

Fig. 6

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/22   H04L29/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☐ Further documents are listed in the continuation of box C.   ☒ Patent family members are listed in annex.

Date of the actual completion of the International search	Date of mailing of the International search report
12 November 2002	29. 11. 2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	ELISABET ÅSELIUS/JA A

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

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